Desoto Independent School District

i3 Development Grant

iSTEAM3D Initiative

A. Significance

(1) Project involves the development of promising new strategies that build on strategies...

In response to the ***Absolute Priority (2)*** Improving Science, Technology, Engineering, and Mathematics (STEM) Education, and the ***Competitive Priority*** – Novice, DeSoto Independent School District (DISD), in collaboration with its T-STEM Academy, University of Texas at Dallas, DeSoto Arts Commission, EduTopia, Project Lead the Way and Buck Institute for Education, will scale-up its innovative iSTEAM3D initiative for students (K-12). DISD serves **9,400** students of which **80%** are African American, **17%** are Hispanic, **70%** are low-income (free/reduced lunch), **34%** are at-risk, **6.8%** are English Learners, and **10%** are students with disabilities (Texas Education Agency 2013-14). DISD consists of **12** campuses: **7** elementary, **3** middle, **2** high, and **1** alternative. DISD's predominantly minority student population is notably more low-income and at-risk of not completing high school than the average Texas student.

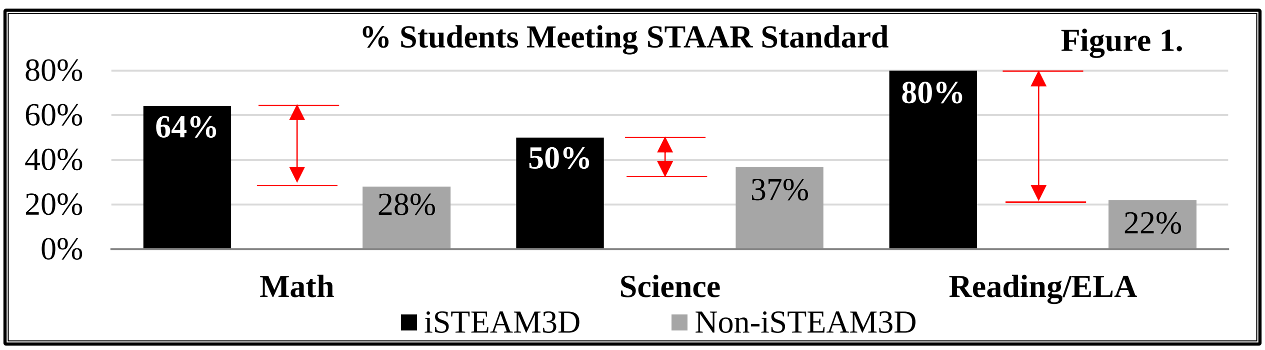
DeSoto is a small suburb located south of Dallas. The population of **60,237**consists of **70%** African-American, **10%** Hispanic, **42%** high school graduates with no college, unemployment rate is **8%** and over **29%** of families fall below the poverty level (2014 U.S. Census). Despite its proximity to the flourishing Dallas area, DeSoto suffers educationally and economically.

Arts in STEM = STEAM: The integration of the Arts with STEM is not about just adding the Arts to STEM. Rather, it is more about fundamentally changing education to incorporate the experimentation, exploration, and discovery that is at the heart of effective STEM education. Hoachlander and Yanofsky (2011) insist, "STEM might have more STEAM if it actually paid attention to the arts, acknowledge the importance of creativity and design in STEM-related fields" (p. 2-6). In 2008, the Conference Board and Americans for the Arts, in association with the American Association of School Administrators, conducted a survey of **244** corporate executives and school superintendents in an attempt to define the role of creativity. The study, called "Ready to Innovate," indicated that companies want employees who can identify problems, identify new patterns, integrate knowledge across disciplines, originate new ideas, and work with a fundamental curiosity (Lichtenberg, et al, 2008). The research findings point out that most high schools and employers provided such education and training only as an elective or as-needed basis (Lichtenberg, et al, 2008). Given the results of this study, it is evident that the arts have a case to make for a greater integration into all programs that advocate creativity as a goal. Wooten (2008) believes that involvement of the Arts in STEM can provide joy and happiness in learning. Development of a love for learning can have a profound effect on a student's education.

Promising Strategies: Gardner identifies "profile of multiple intelligences," an individual who applies one or several combinations of intelligences (language, logical mathematical analysis, spatial representation, musical thinking, use body to solve problems, an understanding of others, and of ourselves) to complete tasks, conceptualize or problem solve, and explore understanding across domains (Gardner, 2011). Concepts embedded in arts integration are referenced as a method for students to explore deeper understanding by accessing various intelligences (Russel-Bowie, 2009). Regarding education, Gardner (2011) argues equilibrium must exist between students' "analytical," "creative," and "practical abilities." For students to understand a concept and solve a problem, he/she must appreciate one's inherent creative abilities, and apply multiple intelligences to link the concept/problem in practical ways to real-world situations (Wilson and Conyers, 2013). Integration of Arts disciplines in STEM learning will allow students to do that.

iSTEAM3D: This initiative has been piloted in three DISD middle schools (grades 6 – 8) over the last **three years** through iSTEAM3D Academies with nearly **100** students in each campus for a total of **300** students annually. The **iSTEAM3D** takes the STEM and adds the Arts – STEAM with the 3D standing for "discovering, designing and developing." Using ***Project-and Problem-***

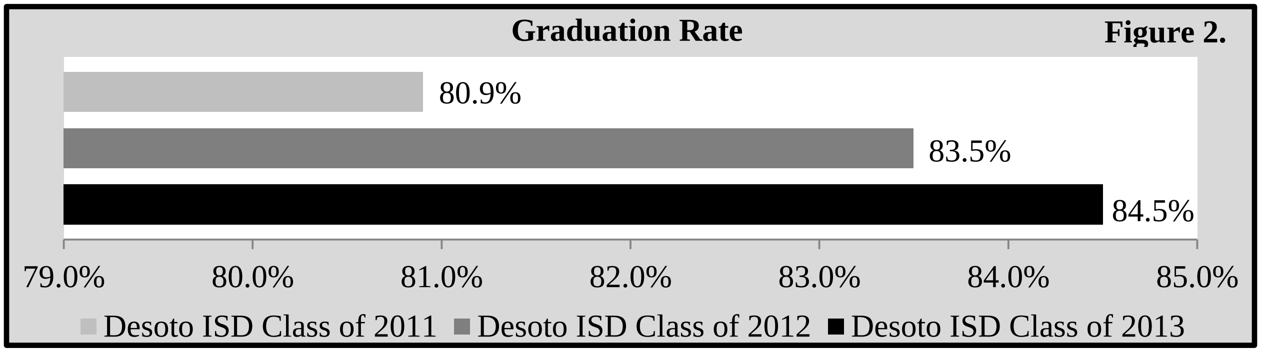
Based Learning (PBL) as the crux of instructional model, the **iSTEAM3D** focuses on creativity, innovation, design and capitalizes on the artistic and analytical learning capabilities of each participating student. The **iSTEAM3D** engages students in an arts-integrated program of study in Math, Science and technology, each of which provides a strong foundation in the skills necessary for success in the 21st Century. These learning experiences have demonstrated that **iSTEAM3D** students outperform their non-participating peers in meeting State of Texas Assessment of Academic Readiness (STAAR) standards in Math. In 2013-2014, the performance of **iSTEAM3D** middle school students in **6th**, **7th** and **8th** grade meeting STAAR standards in Math was **46%**, **64%** and **82%**, respectively, compared to non- iSTEAM3D students at **16%**, **26%** and **42%**. Likewise, **iSTEAM3D** students (6th – 8th) outperformed **non-iSTEAM3D** students in Science and Reading during the same time period, as depicted below (See Figure 1).



Source: Texas Education Agency: Texas Academic Performance Report (TAPR) 2013-2014

In addition, in a recent survey conducted, students (N=285) indicated that **iSTEAM3D** enhanced their problem-solving skills (**63%**), knowledge of core content (**75%**), and positive attitude towards postsecondary education (**82%**) which are essential for a successful future.

As a result of the **iSTEAM3D** initiative, DISD students, particularly at-risk students of color, have shown great strides academically, intellectually and socially. Over the years, DISD students have demonstrated the ability to make good choices and significantly excelled in high school graduation as depicted below (See Figure 2). See also Appendix 2 – TEA Accountability.



Sources: Texas Education Agency: Texas Academic Performance Report (TAPR) 2011-2013

To validate DISD **iSTEAM3D's** effectiveness on target educators, students and outcomes depicted above, see Appendix C – Eligibility and 3 – McGraw Hill Multi-Year Data Analysis.

(2) The national significance of the proposed project…

As it stands, traditional STEM education prepares students for highly technical jobs in hopes that the United States (U.S.) workforce can propel its economic prowess back to dominance (ASHE, 2011). However, this push has grown stagnant in recent years. While graduation rates of STEM candidates have grown over the past decade, U.S. lags behind their foreign counterparts in STEM education (ASHE, 2011). Current research implies domestic inequalities have begun to surface in U.S. STEM training and educational institutions. Many students avoid a STEM education because it is viewed as stiff, regimented, or mechanical with a pre-programmed set of academic solutions (Sonnert & Fox, 2012; Gonzalez & Kuenzi, 2012). In particular, women, minority groups, and poverty stricken students feel disconnected to the content. For example, in mathematics, the achievement levels are disproportionate between other ethnic groups.

According to Flores (2007), there exists a significant achievement gap in Mathematics between African American and Latino students versus that of white students. Flores (2007) posits that impoverished students fall significantly behind those students from a high socio-economic status. Factors such as a lack of motivation, engagement, and supportive environments are cited as causes for minority students exiting STEM initiatives (ASHE, 2011).

The integration of Arts into STEM (STEAM) has been gaining traction recently. The instructional methods of yesterday, utilizing lecture and busy work, are no longer effective in today's classroom; the requirements of today's learners are changing and evolving more than ever before (Finn & Ravitch, 2007). STEM disciplines are realizing a gap in technical thinking and abstract construction, creativity and application (Sousa & Pilecki, 2013). STEM practitioners are embracing principles of the art world to invigorate innovation in the educational paradigm. Seemingly, scientific and art arenas are working in unison. Several conferences were recently held by the National Science Foundation (NSF) and National Endowment for the Arts (NEA) in an attempt to bridge the two disciplines (Eger, 2013). House Resolution 319, introduced by Representative Jim Langevin (D-RI), expresses the sense that adding art into federal programs that target STEM fields, encourages innovation and economic growth in the U.S. DISD believes that art and STEM, when integrated, are poised to transform education in the 21st century, in the same way science and technology did in the last century, and the STEAM movement is an opportunity for DISD to sustain its role as innovator in the education community.

Evidence of Promise: Sousa and Pilecki (2013) believe art and STEM have the same mission – discovery and creation. Despite limited research on systemic STEAM applications, there is a plethora of information concerning the impact of Arts integrated STEM instruction and examples of its premise in practice. Arts integration in STEM has also been shown by a rigorous study to increase student engagement and achievement among youth from low socioeconomic backgrounds (Catterall, Dumais, & Hampden-Thompson, 2012). This study examines the relationship between participation in the arts and academic and civic outcomes for young children, teenagers and young adults. Researchers analyzed data from four large-scale, longitudinal, national data sets to examine how a student's level of arts participation during the K-12 years is related to his/her academic achievement and civic engagement. Researchers compared outcomes for students from low socio-economic status (SES) backgrounds with low participation in arts activities, low SES youth with high participation in arts activities, high SES youth with differing levels of arts engagement, and the general population. Researchers found that students with high participation in the arts outperformed peers with low arts participation on measures of academic and civic outcomes in the examined data sets (Appendix D - Evidence).

Hypothesis: The integration of the Arts in STEM and the development of an integrated K-12 **iSTEAM3D** pipeline through PBL strategies will substantially improve DISD students' interest, engagement, academic achievement levels, graduation rates and overall college enrollment.

(3) Replicability of the project or strategies, including implementation in a variety of settings…

DISD and its partners (T-STEM Academy, University of Texas at Dallas (UTD), DeSoto Arts Commission (DRC), EduTopia, Project Lead the Way (PLTW) and Buck Institute for Education) will scale-up **iSTEAM3D** initiative by adding **two (2)** magnet academies or **200** K-12 students at each school level (elementary, middle, and high school) serving **600** new students each year for a total of **1,800** students over the project period. Students enrolled in each magnet school will be intentionally selected through a lottery process and methodically randomized so that the magnet schools have a wide cross-section of students, including low-income, minority, students with disabilities, English Learners, gifted and talented, and so on. The purpose of the **iSTEAM3D** magnet academies is to integrate Arts disciplines and project- and problem-based strategies in STEM learning, offering educators the tools and professional development opportunities to implement outcomes-based, arts-integrated STEM lessons in their classrooms for enhancing student academic engagement, achievement and college/career readiness.

The following research-supported strategies will be implemented at each proposed magnet school: **a)** forge strong links between Arts and STEM curricula (Math and Science) based on a foundation of carefully-planned learning goals that align with STAAR standards (Hoachlander and Yanofsky, 2011); **b)** incorporate instructional and assessment components in pedagogy and create PBL-driven student learning opportunities that enable students to master content and develop 21st century skills (Silverstein & Layne, 2010); **c)** provide professional development and technical assistance to educators (teachers, staff, and principals) such as, but not limited to, initial transition support to PBL, collaboration (internal/external), ongoing support structures, and arts integrated STEM curricula and technology-enabled instructional practices (Nobori, 2012); and **d)** give students access to rigorous coursework, mentoring, advising/counseling, and enrichment activities (STEM/Arts camps and events, college visits, community-based service learning, etc.) that foster high levels of real world exposure, learning, and college and career readiness for all students (President's Committee on the Arts and the Humanities, 2011).

Project- and Problem-based Learning (PBL): PBL is grounded in learning theories which include situated learning, constructivism, meta-cognition, self-directed and cooperative learning (Kwan, 2009). By linking PBL with STEM and Arts content, personalized, technology-enabled instructional practices, and STAAR standards, **iSTEAM3D** will enable students to explore STEM content with real-world problems, which ultimately impacts achievement and engagement levels of students in all grades. Compared to traditional instruction, PBL raises long-term retention of content, helps students perform better than traditional learners in tests, improves problem-solving and attitudes towards learning in all settings (Strobel & van Barneveld, 2009).

Capacity Building: **iSTEAM3D** is based on an ongoing capacity building approach that aims at empowerment through knowledge and skills acquisition. This approach has proven to be effective in teacher training and building capacity (Barron & Darling-Hammond, 2008). Thus, a sustainable foundation of trained teachers who build the knowledge base and skills of other teachers of DISD will be created to teach and integrate arts disciplines in subject areas within the frameworks and standards defined by Texas Essential Knowledge and Skills and STAAR.

Replicability: Research shows that early exposure is essential as interest in STEM often begins to flourish in elementary school and influences middle and high school students in developing future educational aspirations (Tai, Liu, Maltese, & Fan, 2006). A recent study (2010-2014), funded by the US Department of Education (USDOE) and conducted in Fairfax County, VA, found teachers using Wolf Trap Institute's arts-integrated instructional strategies have significant positive effects on children's early learning. DISD, with i3, will scale-up **iSTEAM3D** to ensure all students (K-12) are engaged in highly-effective proven strategies. Scaling up **iSTEAM3D**, will have a significant impact on DISD students because it does not have arts inextricably integrated with daily STEM curriculum. PBL units will be vertically and horizontally aligned with STEM curricula. Through **iSTEAM3D**, DISD will refine PBL units, and integrate and test digital content to support STEM content redesign. Therefore, there is no doubt that **iSTEAM3D** can easily be replicated in all grade levels to improve student achievement district-wide.

B. Quality of Project Design

(1) The goals, objectives, and outcomes to be achieved are clearly specified and measured.

The **proposed goal** is to increase the STEM competencies of low-income and under-represented students of color through creativity, innovation, and engagement activities that capitalize on artistic learning through PBL strategies so that all students are prepared to successfully function and compete in college and the technological 21st century workforce.

Objective 1: Design and implement STEM instructional practices through Arts integration that connect Project-Based Learning strategies to technology and Arts curricula.
1.1 Each year, **70%** of target teachers will demonstrate an increase in pedagogical content knowledge linked to state standards during classroom instruction while increasing by **5** percentage points annually or until **78%** show an increase, as measured by observation rubric. **1.2** Each year, **70%** of target teachers will report using student-led data to inform instruction, increasing by **5** percentage points annually or until **78%** report such use, as measured by survey. **1.3** Each year, **70%** of target students will report utilizing technology STEM learning with adaptive content and Arts integration at least twice per week, increasing by **5** percentage points annually or until **85%** report such use, as measured by student survey.

Objective 2: Create a blueprint that develops highly-effective principals and teachers that support, sustain and scale-up STEM disciplines through Arts integration school-wide.
2.1 Each year, **70%** of target teachers receiving professional development in STEM strategies (pedagogy) and Arts integration, will report improvement of incorporating STEM and Arts concepts in core content areas, as measured by observation rubric and self-assessment tools. **2.2** Each year, **50%** of target principals and teachers will be categorized as high-quality, as defined by i3 definition, increasing by **10** percentage points annually or until **70%** are classified at this capacity, as measured by principal and teacher evaluation appraisal system. **2.3** Each year, iSTEAM3D will be scaled-up at the elementary, middle and high schools by adding **2** units at each school (**6** units) for a total of **1,800** students or until **50%** of the students at each level are engaged in iSTEAM3D, as measured by a pre/post school climate survey.

Objective 3: Increase the number of students prepared to graduate high school on-time and who pursue postsecondary education targeting STEM courses and careers.
3.1 Each year, **70% and 58%** of target students will score at proficient level or above on the state (STAAR-EOC) assessment in Math and Science, respectively, increasing by **5** percentage points annually or until **78%** and **64%** of students show proficiency or above. **Baseline – Math 64% and Science 50% found in Figure 1 pg. 3.** **3.2** Each year, **70%** of target students will increase their competencies in STEM and Arts disciplines, increasing by **10** percentage points annually or until **85%** show such an increase, as measured by validated pre-post instrument. **3.3** Each year, **23%** of target high school students will receive credit in an Advanced Placement (AP) Math or Science course, increasing **5** percentage points annually or until **26%** of students are receiving credit in an AP course, as measured by state course (TAPR) data. **3.4** Each year, **84% (83.5% baseline)** of target students will graduate on-time of which **70% (60% baseline)** will enroll into college pursuing a STEM career, increasing by **5%** annually or until **93% and 78%,** respectively of graduates enroll into college, as measured by Texas system.

PBL-Driven Student Learning Opportunities: PBL will be used by teachers to teach content and build vital 21st century skills (such as collaboration, communication, inquiry, and critical thinking) essential to student success as they progress through high school and into college and careers. Using problem-based learning (PBL) **iSTEAM3D** will: 1) provide ongoing engagement of students through arts integrated STEM magnet programs in a K-12 STEM pipeline; 2) link PBL with STEM course content connected to the Texas STAAR standards; 3) integrate PBL units across all courses to enable students to explore STEM-related issues with real-world experiences; 4) connect PBL and digital course content to technology-enabled instructional practices to impact achievement and engagement of students (Barron, B., & Darling-Hammond, L., 2008); and 5) enable teachers to be facilitators of knowledge via substantive improvements in the way curricula, pedagogy, and assessments are conceptualized and implemented (Asghar et al., 2012). Teachers will implement inquiry-based methods and differentiated teaching strategies to engage students in hands-on, PBL activities focused on a specific STEM-related, career-related, or a community service learning. Students will create digital portfolios to document their learning, connect flexibly with peers through learning technologies, and participate in performance-based assessments. It is anticipated the above activities will raise long-term retention of content, help students perform as well or better than traditional learners in high-stakes tests, improve problem-solving and attitudes towards learning (Walker & Leary, 2009).

Grade Level Relevance: Understanding that students in elementary, middle and high school have different academic, cognitive and non-cognitive needs, DISD will customize "Whole School Level" the **iSTEAM3D** curriculum, pedagogical instructional strategies, digital content, etc., (National Research Council 2013). Based on STAAR and the Texas Essential Knowledge and Skills (TEKS) standards, **the iSTEAM3D** curriculum will include project- and problem-based learning activities, in which students will take on challenges to solve real-world problems while developing 21st century skills such as innovation and creativity. For instance, DISD **iSTEAM3D** students will be involved in "World Connection" virtually with students from other countries – China, Columbia, etc. and work together on numerous STEM, engineering and related school projects. Middle and high school students will use tablets to research projects and to design and produce deliverables, just as they would in the workplace. Students will learn to code and be engaged in creating skits, artwork, and other artistic presentations to demonstrate the mastery of STEM subjects. The lesson plans will integrate engineering design and STEM – from the mathematics of building bridges to the art of designing objects that go in their community. Additionally, **iSTEAM3D** will create a visiting artist program where local professionals will participate in art workshops for elementary students to get them excited about STEM. For example, online programs/games that embrace STEAM concepts (such as Fantastic Contraption, Foldit, etc.) will be used to spark curiosity and inquiry among elementary students.

Professional development (described below) for educators will also be tailored for each grade level (Leslie, D.A. 2011). This past year DISD's Deans of Instruction have been working with curriculum leaders (Pearsons, Project Lead the Way and Center for Development in Fine Arts) to create new STEM/Arts curriculum aligned to TEKS (Appendix 4 – Curriculum). During this process, DISD focused on eight categories: Values, Collaboration and Planning, Curriculum and Instruction, Professional Learning, Communication, Partners and Resources.

Instructional Strategies: Each year, Art Instructional Coaches will be placed at each magnet school to work in close partnership with content and master teachers to encourage, inform, and extend the use of high-quality arts instruction in academic classes and to strengthen the place of the Arts in STEM curricula. Instruction will be differentiated to meet the range of students' (K-12) needs within the classroom. The process will begin in the elementary schools and continue through high school. Customized instructional (K-12) strategies will focus on cognitive, non-cognitive, social, and emotional development of students for each grade level. DISD believes that project-and problem-based learning must be in the daily curriculum of every grade (K-12) level so students understand and master STEM concepts and develop problem-solving skills.

Given the recognized heterogeneity of students, further differentiation will occur based on time (age, grade level relevance, etc.) appropriated for task, range of resources for students to utilize, and the nature and amount of assistance given to students to be successful. To achieve the above objectives and outcomes, the curricula will also be differentiated in terms of pedagogy. The needs of differing learners such as elementary versus middle and high school students, English Learners, special needs students, underrepresented minorities, female, and gifted students will be facilitated by a range of differentiated instructional strategies and pedagogical models. Evidence indicates that differentiating the curriculum without simultaneously differentiating instruction does not allow all students equity to learning (Kaplan 2009).

Professional Development: Implementing **iSTEAM3D** will require a shift in thinking of DISD educators. This will not be possible without considering how to best support educators as they transition into the **iSTEAM3D** instructional model. DISD will scale-up its **iSTEAM3D** journey by partnering with programs that have researched the integration of STEAM-related content into the core curriculum. Partners will assist DISD educators as described below and in Appendix 5.

Table 1. Partner	Role in Professional Development
T-STEM Academy	STEM capacity building, coordination, coaching, and mentoring
UT at Dallas	Project-and problem-based learning training on STEM/Arts pedagogy
Arts Commission	Guide, support and train educators Arts integration into STEM curricula
Edutopia	Assessment, leadership and teacher training and technology integration
PLTW	Curriculum alignment, pedagogy, capacity building training and coaching
Buck Institute	Project-based Learning training to teachers on proven practices (K-12)

iSTEAM3D teachers will participate in 35 hours of professional development annually. Topics will include, but not be limited to: differentiated instruction, high yield strategies, project- and problem-based learning, culturally relevant and responsive education, support for English Learners, assessment tools, TEKS, STAAR standards, and data driven decision-making. Additionally, training will focus on research-based strategies to effectively meet the needs of diverse learners (elementary, middle and high school students), including students with special needs. Professional development and ongoing technical assistance will be provided to participating teachers and educators in analyzing, reflecting upon, and improving their teaching practice both independently and collaboratively through professional learning communities and common planning time. Training for administrators will include (but not limited to): 1) use of data as an effective framework for designing and implementing **iSTEAM3D**; and 2) engagement of students and their parents through institutional supports and resources designed to personalize education to improve achievement of students in STEM. STEM and Arts Master teachers will play pivotal roles in assisting teachers on a variety of pedagogical practices based on inquiry teaching and learning: group investigation, Socratic seminar, and project-based learning.

Professional Learning Community (PLC) and Common Planning Time (CPT): The PLC will foster ongoing interaction and communication among teachers and educators on ways to create, pilot, and validate lesson plans and classroom activities (K-12) for the arts-integrated STEM curriculum. Weekly CPT (45 minutes) time for teachers will be used to develop lesson plans with benchmarks and assessment tools specific to student (K-12) learning. The PLC and CPT will also be utilized by participating educators to discuss project- and problem-based learning and student-let data strategies that could enhance higher-order thinking skills, including creativity, persistence, craftsmanship, and problem solving among students (Burton, et. al 2009).

Rigorous Coursework: To increase the number of students graduating high school on-time and pursuing college targeting STEM and preventing them from taking remedial courses, DISD will increase students' access to rigorous courses in math, and science through the Distinguished Achievement High School Program or the Recommended High School Program (Appendix 6). This will begin with the development of a **Student Learning Plan (SLP)** during elementary years to include a personalized sequence of instructional content and skills development for each student that will lead towards mastery of graduation requirements and college-and career-readiness standards and endorsement (prior to graduation). The **SLP** will follow each student through the project period and be reviewed every six months by a counselor and Master Teacher to assess progress. During high school, students will begin coursework toward the Foundation High School Program (Appendix 7) and will be prompt to select STEM endorsement courses aligned to college and career pathways. Year-round emphasis will be on increasing secondary students' access to challenging courses in math, and science through enrollment in pre-AP, AP, and dual enrollment courses linked to both academic and Career Technology Education courses.

Advising: Students (K – 12) will receive comprehensive advising by Master Teachers which will involve his/her parent in an advisory system aimed at ensuring that each student completes a coherent program of academic study. Extra help before, during and after-school will enable struggling students to successfully complete an accelerated or developmental education program of study that includes high-level academic and social content (Wilson & Conyers, 2013)**.** DISD will provide opportunities for **Student-Led Conferences (SLC)** starting at the elementary level through high school. During **SLCs**, students explain their progress toward and mastery of both academic (content/skill) and character (non-cognitive work and behavior) learning targets. Students justify their progress by leading their families through a portfolio of assignments culled from academic classes (Pihlgren, 2011). The underlying ideas are socio-cognitive/non-cognitive, socio-constructive, and formative: If the student understands his/her results, goals, and means to get there, learning will be more effective (Pihlgren, 2011).

Enrichment Activities: Participation in PBL enrichment activities, Summer Bridge, internships, job shadowing, educational study trips, college/engineering camps, and workshops will allow elementary, middle and high school students to be critical thinkers, develop both cognitive and non-cognitive aptitudes including study and organization skills, and be college-ready through success in advanced courses (Roderick, Nagaoka, & Coa, 2009). These customized grade-level activities will supplement core curriculum as well as provide college/career exploration opportunities for students at the appropriate level. Local employers will contribute substantial resources by serving as advisors and providing work-based learning opportunities, advising and mentoring youth, exposing all students to careers, and encouraging them to pursue postsecondary education. Students and parents will also hear from professors, counselors and businesses leaders about different college and career pathways which will also enhance interests and motivation.

(2) Adequacy of the management plan to achieve the objectives on-time and within budget…

The above activities will be implemented effectively by executing a management plan that utilizes established organizational and operational structures. This will ensure objectives are met.

Management Plan: Serving as the fiscal agent, the **iSTEAM3D** will be located in the Division of Curriculum and Instruction. Through this division, DISD pledges their commitment, facilities, personnel, resources and active participation to ensure iSTEAM3D is an integral part of its daily operations (Appendix G – Letters). As a recipient of multiple federal grants (e.g. GEAR UP), DISD has administrative, programmatic, fiscal, management and evaluation systems in place that meet the highest standards of accountability. DISD will use this management experience, leadership and knowledge in the management of the **iSTEAM3D** program. These administrative systems use the latest organizational managing software (e.g. GrantsMaximizer), communication systems, fiscal appraisals (supplement not supplant), effective staffing plans, customer feedback mechanisms, techniques for organizational control and continuous quality improvement. Program control utilizes current technology for participant tracking (Youth Connection – Appendix 8), monitoring progress, sharing of resources, assessing accountability, management of information, evaluation, reporting and oversight. DISD will use this management experience for **iSTEAM3D** to ensure the delivery of effective, quality, and culturally relevant services.

Coordination: To provide guidance and oversight in implementing **iSTEAM3D** effectively, a **Steering Committee** (**SC**) will be formed. A representative from each partner, Project Director, Superintendent, principals, teachers, evaluators, parents, and community representatives will serve on the **SC**. Facilitated by the Project Director, the **SC** will meet quarterly to assist with planning, coordination, budgeting, and evaluation to ensure employment of a sound, sustainable, and scalable **iSTEAM3D** program that is inclusive of both federal and non-federal resources.

Key Personnel: DISD recognizes that effective management of this program requires strong leadership skills and academic training. Dr. Jo Green-Rucker, Assistant Superintendent of Curriculum and Instruction with over 29 years of educational and management experience of federal programs, will oversee the program and supervise the Project Director. Dr. Jo Green Rucker, with a Doctorate in Educational Leadership, will dedicate 20% of her time at no-cost. Also, Ms. Debbye Gardner, Director of Professional Development with a Masters of Education will assist (20%) Dr. Rucker and the Project Director with the i3 implementation at no cost.

DISD, when hiring **key** personnel, will seek professionals who are highly educated and best Qualified. The **i3 team** (below) will be comprised of nine high-qualified educators. Table 2. highlights the **iSTEAM3D** staffing plan to ensure an effective and high-quality implementation. (See Appendix 9 – Organizational Chart and Appendix F – Resumes/Job Descriptions).

Table 2.	**Key Personnel (KP) Qualifications (Q) and Responsibilities (R)**
KP	**Project Director (1 FTE) – hire within one month of award**
Q	A Masters in Education and Administration required and/or a Doctorate preferred; Texas Principal or related certification required; Eight years of experience in successfully administering and managing federal programs required; Experience working with diverse partnerships and managing in-kind resources required; Experience in managing sizeable budgets successfully and meeting multiple deadlines and reporting requirements; and Supervisory experience with large grants and a proven track record of success.
R	The Project Director will oversee the i3 program and be responsible for the overall project implementation and budget management, lead the iSTEAM3D Team, work with all school personnel, partners, external evaluators, and be the liaison to the USDOE i3 Office.
KP	**STEM Instructional Coaches (2 FTEs) & Arts Instructional Coach (1 FTE)**
Q	Masters in Math, Science or Arts and Texas Teaching Certificate with five years of teaching experience in target content areas; Knowledge of Texas Essential Knowledge and Skills (TEKS); and Experience in providing professional development and coaching.
R	Provide technical assistance (pedagogy); Guide STEM course content and instructional approaches including Arts integration into core content; offer one-to-one assistance to facilitate the integration of STEM and Arts PBL units; and monitor classroom teachers.
KP	**Master STEM Teachers (3 FTEs) & Master Arts Teachers (2 FTEs)**
Q	Masters in Math, Science or Arts and Texas Teaching Certificate with three years of

	teaching experience in target content areas and working with high-need diverse students; Knowledge of TEKS; and Experience in providing campus assistance to content teachers.
R	Provide Math and Science high-quality instruction to target students while integrating Arts disciplines into core content; offer extended-day out-of-school instruction to accelerate learning; Mentor and guide non-Master teachers; and facilitate the weekly PLCs.

Additionally, the management plan is designed to integrate the following elements to achieve the goals, objectives, and outcomes (pg. 8 – 9) of the program on-time and within budget.

Service & Monitoring: To maintain accountability and to ensure high-quality products and services are delivered (on-time and within budget), the Director will utilize the Logic Model (Appendix 10) as a guide and work closely with all stakeholders including the external evaluator to ensure full implementation and oversight of program activities. The Director will ensure program effectiveness by maintaining a high-level of open communication among staff, school personel, community and vendors. The **i3 team** will meet weekly to review program progress, student development, educator progress, cost efficiencies and areas needing improvement. The staff, evaluator, and partners will provide monthly reports to the Director detailing project status, pre or post-results, progress and areas needing immediate attention. The Director will also meet monthly with the finance department to track costs and quarterly with the **SC** to review program status and actual expenditures against proposed costs and milestones to maximize resources.

Instructional support and continuous data monitoring and assessment through face-to-face and online digital platforms will be a priority. DISD and the evaluator will collect ongoing qualitative and quantitative data (students, parents and teachers) and conduct data analyses to determine the growth/decline on each outcome. The timeline below was developed as a tool for managing the attainment of key objectives, milestones, reviewing the progress of the proposed program and cost efficiencies. Each year the **i3 team** will review and update tasks, timelines and milestones for the next year based on educators' development, student academic progress, and parent educational knowledge. DISD anticipates the start date will be January 1, 2016.

Table 3. Administrator-AD; Director-PD; STEM Coach-SC; Arts Coach-AC; Master STEM Teacher-ST; Master Arts Teacher-AT; Partners-P; Educators-E; Evaluator-EV			
Activities/Milestone	**Responsibility**	**Timeline**	**Obj.**
Upon Award Steering Committee meet and plan	AD, E	Jan '16	1,2,3
Hire Project Director and provide orientation	AD, E	Jan '16	1,2,3
Hire STEM/Arts Coaches and Master Teachers	PD, E	Feb – Mar '16	1,2,3
i3 team/Evaluators meet, formulates data collection plan, develops database and collects baseline data	PD, C, S, E, EV	Feb '16 – Ongoing	1,2,3
Identify professional development needs of staff, partners and committee members and begin training	AD, PD, SC, AC	Mar '16 – Ongoing	1,2
Engage T-STEM, UT Dallas, DeSoto Arts Commission, EduTopia, PLTW and Buck Institute	PD, SC, AC, P	Mar '16 – Ongoing	1,2
Meet with i3 staff, principals and partners to develop Annual Master Schedule	SC, AC, ST, AT	Mar '16 – Annually	1,2,3
Set up Magnets, lottery and select K-12 students	PD, ST, AT, E	Mar '16 – '18	1,2,3
Engage students in iSTEAM3D STEM/Arts instructional lessons and digital integration	ST, AT, E, P	Mar '16 – Ongoing	1,3
Schools design and implement weekly PLCs	ST, AT, E	Apr '16 – '18	2
PLCs begin the curriculum design with STEM disciplines and Arts integration, with PBL and CPT	PD, ST, AT, E, P	Apr '16 – Weekly	2
Develop, implement and test PBL units within the elementary, middle and high schools	PD, SC, AC, E	Apr '16 – Ongoing	1
Modify PBL units and provide training on digital STEM/Arts content integration aligned to TEKS	AD, SC, AC, E	May '16 – Annually	1
Assess the fidelity of iSTEAM3D, PBL, and PLCs including technology and Arts integration	EV, AD, PD	May '16 – Quarterly	1,2
Implement the quasi-experimental design (QED) and student selection through randomization/lottery	EV, PD, E	May '16 – When needed	1,3
Develop, test, disseminate and collect surveys (student, educators, parents, partners, etc.) and data	EV, SC, AC, E	May '16 – Quarterly	1,2,3
Identify at-risk students, assess aptitudes, skills, abilities and interests	SC, AC, E	May '16 – Ongoing	3
Engage students in extended-day accelerated learning opportunities (after-school, summer, etc.)	ST, AT, E, P	June '16 – Ongoing	3
Implement student STEM/Arts summer CAMPs, educational field trips, and parent engagement	PD, SC, AC, ST, AT, E, P	June-July '16 – Ongoing	1,3
Compile, clean, analyze and review student data for program recommendations	EV	Jun '16 – Annually	1,2,3
Review PBLs content and PLCs personalized practices and strategies	AD, PD, SC, AC	July '16 – Annually	1,2
Assess technology integration within the PBLs and modify, as appropriate	AD, PD, SC, AC	July '16 – Annually	1
Implement Educator Summer Institutes for program in-service and capacity building	PD, SC, AC, E, P	Aug '16 – Annually	2
New iSTEAM3D School Year 2017			

Review data, tailor and incorporate data-led student interventions and best practices in new school year	AD, PD, EV, E	Aug-Sept'16 – Biannually	1,2,3
Begin one-on-one teacher classroom advisement, guidance, coaching and mentoring	PD, EV, SC, AC	Sept '16 – Annually	1,2,3
Attend the i3 Conference/Meeting in WA D.C.	PD, EV, E, P	Sept '16 – '18	1,2,3
Magnet schools, selection of students and student engagement in iSTEAM3D continues	AD, PD, ST, AT, E	Sept '16 – Annually	1,2,3
Implement PBL units aligned with digital STEM/Arts content integration in line with TEKS	AD, SC, AC, E	Oct '16 – Annually	1
PLCs curriculum with STEM disciplines and Arts integration implemented and reviewed during CPT	PD, ST, AT, E, P	Oct '16 – Weekly	2
Submit Annual Performance Report to USDOE	EV, PD	Dec '16 – '18	1,2,3
New iSTEAM3D School Year 2018			
Replicate Year 2 modified data-led student and educator (PBL, PLCs) activities and programs.	PD, SC, AC, ST, AT, E, P, EV	Sept '17 – Ongoing	1,2,3
Develop a written sustainability and scalability plan	AD, PD, E, EV	Jan '18	1,2,3
Develop an outreach and replicability campaign	AD, PD, E, EV	June '18	1,2,3
Submit Final Performance Report to USDOE	PD, EV	Mar '18	1,2,3

(3) Adequacy of procedures for ensuring feedback and continuous improvement…

Progress: To ensure effective feedback mechanisms and continuous improvement in project operations, the Project Director will: 1) work with project staff on a daily basis to monitor progress, review benchmarks toward performance measures, and make improvements in project design and delivery; 2) meet with campus teachers, principals and educators monthly to assess program fidelity (PLCs, technology integration, pedagogical strategies, curriculum rigor and relevance, student-led data utilization, etc.) to ensure services are effectively being delivered and relevant to participants, as proposed; 3) meet with the Steering Committee quarterly to solicit feedback on project status, operation, and evaluation for program improvement; 4) assess program through biannual interviews and open-ended monthly, quarterly, and/or annual surveys (educators, students, parents) depending on the user, instrument or activity to determine participant satisfaction levels and to monitor academic performance of students; 5) utilize digital management software daily to track and monitor project status and to assess impact on objectives each month; and 6) review quarterly and annual evaluation results to ensure data is strategically used to provide feedback in efforts to refine and integrate effective program improvements.

Also, the participatory evaluation design will utilize formative and summative assessment methods to collect, analyze and triangulate data needed to implement a continuous quality review process. Formative evaluation will provide immediate feedback regarding implementation of activities such as: are they occurring, when, where and to whom? Data-driven summative procedures will measure outcomes, project effectiveness, and overall impact to objectives.

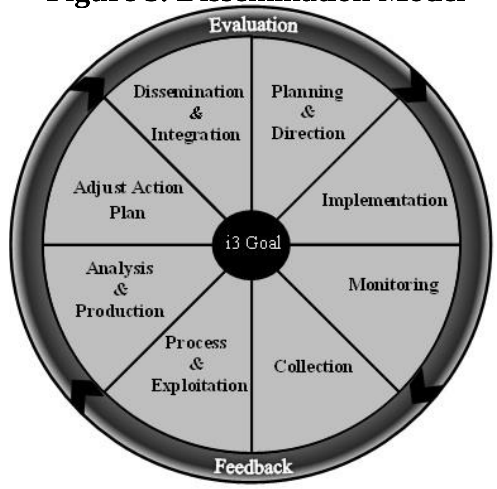
The Logic Model (Appendix 10) will be used as a tool to guide planning, implementation, communication and evaluation to ensure results-based performance. This management tool will depict the logical relationship between the proposed resources, activities, outputs and outcomes. It will offer timely and authentic feedback and information to the evaluator and stakeholders to make informed decisions related to program delivery for continuous improvement. Overall, this model will chart actual progress versus target on all annual benchmarks and long-term outcomes.

(4) Mechanisms applicant will use to disseminate to support development and replication...

DISD will employ a variety of strategies to disseminate program information, evaluation findings and best practices. As part of its evaluation efforts, DISD will: 1) gather qualitative and quantitative data (including data on challenges, lessons learned and best practices); 2) conduct in-depth analysis of short-and long-term performance measures on students and teachers in the experimental and control groups; and 3) aggregate and analyze measures by grade levels, age, gender of students, teaching experience of teachers, and other characteristics, and triangulate the data to provide a synthesis of program-wide, evidence-based data results and conclusions.

These efforts will lead to tangible evaluation interpretations, recommendations, reports and to an electronic implementation manual that will all assist in designing effective strategies for not only program improvement and development, but also for local, regional and national dissemination and replication of **i3** services in different settings. Based on information learned from evaluation efforts, evaluators will describe the implementation of the project; identify critical issues and realizations during operations; and identify the elements and extent to which the program has been implemented with fidelity. This information will be shared with the Board of Trustees, Superintendent, principals, teachers, and **i3** Steering Committee to foster replication of effective activities in school settings. Dissemination of information will also occur through the **i3** web-based portal to provide access to program toolkits, web-link postings, brochures, data dashboards, as well as through presentations at school board meetings, Texas Education Agency symposiums, educational conferences (local, regional or national), school work sessions, college forums, and project reports. Reports will include quarterly and annual progress, data summaries (district/ campus), evaluation reports and final summative reports submitted to the **i3** office. Evaluators will collaborate with **i3** evaluators or designee to disseminate evaluation findings and reports as well as participate with any technical assistance provided. To ensure equitable dissemination, communication will be disseminated in print and digital formats and in English and Spanish.

Figure 3. Dissemination Model



C. Quality of Project Evaluation

(1) Clarity, importance and method of the key questions to address project evaluation…

Independent evaluation will be conducted by a highly qualified evaluation firm, EGT Institute, Inc. to assess the impact of **iSTEAM3D** (Appendix 11 – Portfolio). The evaluation will address four primary questions: 1) What is the impact of **iSTEAM3D** on the instructional strategies of teachers? 2) What is the impact of **iSTEAM3D** on the participating educators' ability to implement arts-integrated STEM curricula in elementary, middle and high schools of DISD? 3) What is the impact of **iSTEM3D** on the academic achievement levels (K – 5th grade, 6th – 8th grade and 9th – 12th grade), engagement, interest, and behavior (non-cognitive) of DISD students and parents? and 4) What is the impact of **iSTEAM3D** on students' motivation and preparedness to pursue college and enrollment in STEM courses? To seek answers to the above questions, EGT Institute will implement two methods of evaluation – Formative and Summative (using a quasi-experimental design – QED). **Formative and Summative Evaluation**: Each year, **formative evaluation** will focus on addressing whether or not the proposed objectives are being met and activities are being implemented as planned. Driven by the Logic Model (Appendix 10), ongoing findings will be compared to objectives, outcome measures (pg. 8 – 9), project timeline, and adjustments will be made, as needed. Baseline data will be collected immediately upon award. The **summative evaluation** plan will utilize a rigorous quasi-experimental design to investigate significance and strength of relationships between proposed and actual activities and services on instructional practices, student academic performances, cognitive and non-cognitive skills development, graduation rates, college enrollment, and outcomes. Evaluation will draw on a wide variety of quantitative and qualitative data (Table 4) to investigate and provide substance and context for both formative and summative evaluation designs that meets the *What Works Clearinghouse* evidence standards. See evaluation design and study methods below.

Table 4. Impact Analysis Summary

Impact Analysis	Data Source & Evaluation Study Methods	Obj.
Question 1: What is the impact of iSTEAM3D on the instructional strategies of teachers? ***Analyzed Annually***	Self-assessments and pre-post surveys from teachers, administrators, and students, classroom observation data, professional development session evaluation data, lessons plans, technology use	1
Question 2: What is the impact of iSTEAM3D on educators' abilities to implement arts-integrated STEM curricula in elementary, middle and high school of DISD? ***Analyzed Annually***	TAPR, PEIMS, pre-post student enrollment data, number of trained teachers/administrators, # and type of PBL activities by grade level, professional development assessment data, AYP data, # of high quality teachers, review of lessons plans, review of school improvement plans	1, 2
Question 3: What is the impact of iSTEAM3D on the academic achievement levels (K – 5th grade, 6th – 8th grade and 9th – 12th grade),	TAPR, PEIMS, student demographics, pre-post STAAR-EOC data, grades by grade level, GPA, # of students participating in PBL activities by grade level, pre-post parent data, # of students reporting	3

engagement, interest, and behavior (non-cognitive) of DISD students and parents? ***Analyzed Annually***	improved understanding of STEM/Arts concepts, # of students in pre-Pre-AP/AP courses and passing, # of students promoted to next grade level on-time, # of students graduating on-time and # of dropouts	
Question 4: What is the impact of iSTEAM3D on students' motivation and preparedness to pursue postsecondary education and enrollment in STEM college courses? ***Analyzed Annually***	National Clearing House and Texas Higher Education Coordinating Board data, pre-post surveys of students, parents and educators, # of students admitted to college, # students enrolled in a STEM discipline, # of students pursuing STEM careers, and # of students not in remedial (math/science) courses	3
***Evaluation of student data will be comprised of both the experimental vs. control group**		

(2) Methods of evaluation, if well implemented produce evidence of projects effectiveness…

DISD will also utilize a rigorous quasi-experimental design (QED) using a multiple-cohort individual-level longitudinal randomized control trial (RCT) approach. Therefore, use of the RCT approach effectively minimizes selection bias and ensures that the treatment and control groups are equitable at baseline in terms of background, demographics, and pre-program factors such as motivation. Quantitative data (e.g. demographics, STAAR results, disciplinary, etc.) will be used in conjunction with ongoing surveys, focus groups (qualitative) and observation data. In addition to the qualitative data mentioned above, the following qualitative data (e.g. school improvement plans, curriculum, instructional leadership – educator evaluations, professional development and its effectiveness, student engagement, academic expectations, and student and teacher perceptions) will also be collected to assess fidelity to ensure a rigorous evaluation.

Beginning in Year 1, DISD will implement a carefully orchestrated lottery process to randomly assign eligible students (treatment) to **iSTEAM3D** (K-12) magnet classrooms and a computer software to randomly select students to non-iSTEAM3D control groups attending the regular school program. The treatment group will consist of **300** (K-12) randomly selected students (lottery process) selected in year one for the **iSTEAM3D** magnet schools. Similarly, a total of **200** (K-12) non-iSTEAM3D students with like characteristics will also be selected (computerized) and assigned to the control group in year one. Propensity-score matching using a

1:1 match without replacement will be used to minimize selection bias and ensure that treatment group and control group students are equated on key background and demographic variables, age, ethnicity, gender, socioeconomic status, experience, and free/reduced lunch status. The quasi-experimental rigorous evaluation and sampling design will meet the What Works Clearinghouse (WWC) evidence standards. Student enrollment and achievement data will be contrasted with the treatment and control group students to provide context for student academic outcomes. Baseline measures will be used to derive change in scores and behavior for students within both treatment and control groups. Specifically, the difference from baseline data (course grades, STAAR-EOC, etc.) and performance measures obtained after participation in **iSTEAM3D** services will be calculated. This method will help guard against selection effects of control students, whereby differences may be found that are due to pre-existing differences between students prior to sampling. Using the above-mentioned data, the evaluator will use statistical significance (t-tests at 95% confidence level), analysis of variance (Anova), and regression (Pearson) analysis to assess quantitative data and the impact to determine the extent to which objectives and outcome measures are attained. Chi-squared test and other factual statistics will be used with qualitative data. Based on the results, the evaluator will provide recommendations to the Director for continuous improvement on an annual basis. Data from the treatment and control groups will be pooled to increase statistical power (**iSTEAM3D** treatment=300, and control=200, n=500), and between-group aggregated and disaggregated comparisons will be conducted for all students annually at the end of each grade level.

The evaluation described above will not only assess implementation, fidelity and outcomes, but will also identify best practices for enhancing cognitive and non-cognitive skills of students**.** The evaluation methodologies will assist in understanding the effectiveness and context of **i3** services in accomplishing the anticipated impacts, as listed in the Logic Model (Appendix 10). For example, to what extent do teacher capacity building initiatives result in practices that are aligned with rigor and relevance necessary for student academic and college success? Also, to what extent are certain "thresholds, dosages, combinations, and components" of **i3** services associated with the development of both non-cognitive and cognitive skills of students? Findings such as these will be of promise/evidence for school leaders for developing early intervention and support systems that better assist students' academic preparedness and college readiness.

(3) Project plan includes sufficient resource to carryout project evaluation effectively…

DISD, through **iSTEAM3D** and in collaboration with its external evaluator – EGT Institute, Inc., agreed to allocate **9%** or **$75,000** annually to conduct the rigorous quasi-experimental study. The evaluation budget was carefully prepared to adequately support the well-designed experimental study and to effectively assess the program objectives, outcomes and fidelity as presented. This cost is realistic and reasonable when compared to the geographical location economic standards and similar **i3** funded projects we identified through our research.

In addition, data driven and longitudinal resources (Texas Student Data System – TSDS, Dashboard Data Mart, Youth Connection, and Acuity) will be used for data and evaluation comparison and analysis (Pearson, Anova) to extract reliable evaluation findings and results. These tools will assist with data driven decision making related to management of curriculum and assessment data for greater student success. Acuity, a state aligned informative assessment tool, will support formative assessment through its unique integration features for classroom-friendly assessments, instructional resources, reporting, and customization opportunities (See Appendix 12). With these assessment tools, efficiency reviews of the **iSTEAM3D** will be completed to examine every aspect to help guide school leaders towards increasing school productivity and costs efficiency for maximizing student achievement.